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Cd. Juárez Manufacturing and El Paso
Industry Linkages

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Introduction

The City of El Paso Economic Development Department views the development of strategies to enhance industry recruitment and retention as a key initiative to promote the regional economy. In an effort to identify opportunities for El Paso industries to become suppliers to the high demand for inputs by the Cd. Juárez manufacturing base, the Institute for Policy and Economic Development (IPED) at the University of Texas at El Paso has undertaken an input-output (I-O) study to examine customer-supplier linkages between Cd. Juárez manufacturing and El Paso industry. Analysis built on strongly associated linkages among industries (via I-O sales and purchasing patterns) provides insight into areas that can be developed to promote regional economic expansion and competitiveness.

The study presents the methodology employed, followed by discussions about Cd. Juárez manufacturing and El Paso's industrial base. Next is analysis of typical commodities or inputs used in the production processes of manufacturing industry groups similar to those operating in Cd. Juárez. Subsequently, insights about the top industries that produce these inputs and whether or not they currently exist or specialize in El Paso are presented. The study concludes by suggesting steps to continue on this initial foundation for examining areas of opportunity to develop existing and potential industry in El Paso to supply the manufacturing sector in Cd. Juárez.

Methodology

The tools and methods available to economic development researchers and practitioners have improved significantly, providing insights heretofore unavailable. One of these tools is input-output (I-O) analysis, which can be used to identify El Paso supplier opportunities to the high demand for inputs from Cd. Juárez manufacturing.

In its simplest form, I-O accounts show how industries interact. Specifically, they track the economic interdependence of what industries sell (provide input) to and buy (use output) from each other to produce a product or provide a service. Put another way, these accounts provide detailed information on the flows of the goods and services that make up the production processes of industries. I-O accounts are presented in *Use* and *Make* tables developed by the U.S. Bureau of Economic Analysis (BEA). The

Use table shows the inputs to industry production while the Make table shows the commodities that are produced by each industry.

The Use table is the most frequently employed table, showing the value, in producers' prices,¹ of each commodity used by each industry. The entry in each row shows the commodity that is used by the industry in the column. For example, Table 1 shows the primary "Commodity Use" (supply row) for the industry "Electronic Computer Manufacturing" (demand column). The majority of inputs required to produce computers are purchased from 1) computer storage device manufacturers, followed by purchases from 2) wholesale traders, 3) printed circuit assembly manufacturers, and 4) semiconductor manufacturers. In sum, the 12 sectors selected for this example (out of nearly 500 total industries) account for almost 93 percent of the commodity inputs needed to produce electronic computers. (Commodity use and inputs mean the same thing and are used interchangeably throughout this study.)

Table 1. Commodity Use for the Industry "Electronic Computer Manufacturing"

Commodity Use		Industry 334111
IO Code	Description	Electronic computer mfg.
334111	Electronic computer mfg.	3.5
334112	Computer storage device mfg.	20.3
33411A	Computer terminals & other computer peripheral equipment mfg.	6.6
334412	Bare printed circuit board mfg.	0.5
334413	Semiconductor & related device mfg.	10.9
334418	Printed circuit assembly (electronic assembly) mfg.	12.9
33461A	Software, audio, & video media reproducing	1.1
420000	Wholesale trade	14.5
484000	Truck transportation	0.6
511200	Software publishers	9.7
541700	Scientific research & development services	2.6
550000	Management of companies & enterprises	9.7

Source: IPED example from BEA Use table.

Note: Values are in percents (e.g., 3.5 means 3.5%).

The I-O Use table for the United States provides the basis for understanding the typical consumption of commodities by Cd. Juárez manufacturing activities. While it would be optimal to apply a Use table representing buy and sell patterns exclusively for Mexico, an updated I-O model currently does not exist for that nation.² However, given that Cd. Juárez manufacturing is closely tied to U.S. production functions, using the U.S. I-O accounts for Cd. Juárez is widely accepted as an efficient alternative.

¹ These prices exclude wholesale and retail trade margins and transportation costs, which are treated separately as commodities that are produced by these respective industries and purchased by intermediate and final users.

² The last detailed I-O table developed by Mexico was in 1980. By comparison, in the United States, the BEA updates I-O accounts every five years (1997 and 2002 were the previous benchmarks). National experts are working on a detailed I-O table for Mexico but results are not available at this time.

Industries in I-O tables are classified using alphanumeric I-O codes, each of which represents a single industry or multiple industries classified under the 6-digit, 2002 North American Industry Classification System (Table 2 illustrates the NAICS hierarchy). For example, I-O code 334111 is the same as NAICS code 334111, both represent manufacturers of “Electronic Computers.” On the other hand, I-O code 33411A corresponds to two NAICS codes, 334113 and 334119, which represent, respectively, industries that manufacture “Computer Terminals” and “Other Computer Peripheral Equipment.” A correspondence table between I-O and NAICS codes is published by the BEA and provides the bridge between the two.³

Table 2. NAICS Hierarchy

NAICS Level	NAICS Example
2-digit (Industry Sector)	33 Manufacturing
3-digit (Industry Subsector)	334 Computer & Electronic Product Mfg.
4-digit (Industry Group)	3341 Computer & Peripheral Equip. Mfg.
5-digit (NAICS Industry)	33411 Computer & Peripheral Equip. Mfg.
6-digit (National Industry)	334111 Electronic Computer Mfg.

For current data (2007) of manufacturing activities in Cd. Juárez, a list of 310 manufacturers was compiled from the Secretary of Industrial Development of the State of Chihuahua and the Cd. Juárez Association of Maquiladoras (AMAC). To study the interaction between industry commodity use and Cd. Juárez manufacturing requires NAICS-based analysis. Unfortunately, individual firms in Cd. Juárez are not classified under a NAICS code. Consequently, it was necessary to manually classify each of the 310 Cd. Juárez manufacturing firms with a corresponding NAICS code, which could then be traced to a respective I-O code. A triangulation technique was used to manually develop this correspondence, first, by classifying individual firms based on their primary production activity if available, and second, by filling in the remaining gaps where primary activity was unknown using a purchased list with regional maquiladora information.⁴

Once Cd. Juárez manufacturing was coded NAICS-based, the U.S. Use table was applied to study the commodity use of these Mexican manufacturers. The key assumption here is that production inputs in Cd. Juárez mirror that of U.S. production inputs for the same manufacturing industry. Once commodity inputs were identified for Cd. Juárez manufacturing, the analysis focused on whether industry exists in the El Paso region that can supply them. It should be noted that the correlation between commodity use by Cd. Juárez manufacturing and El Paso suppliers only tells us whether or not the industry exists in El Paso, but does not tell us whether that industry currently supplies manufacturers in Cd. Juárez. Other steps can be taken to develop a more complete analysis, discussed in the conclusion.

³ *Industries in the 2002 Benchmark Input-Output Accounts*, U.S. BEA.

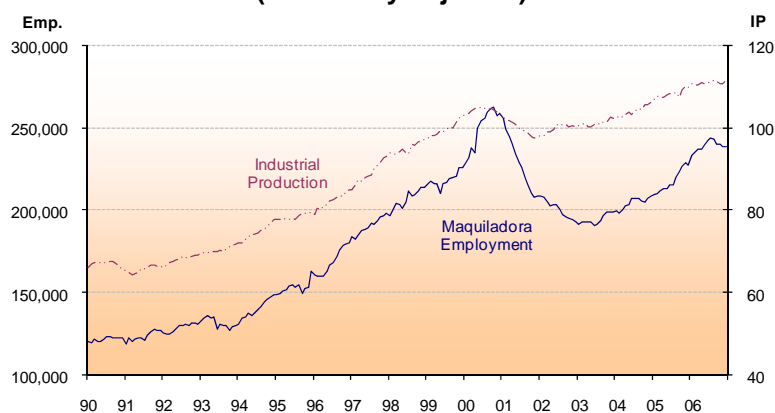
⁴ Solunet: Infor-Mex®, published by OWEN Media Partners, Inc.

Background

Cd. Juárez Manufacturing

Cd. Juárez manufacturing is comprised mainly of the maquiladora (maquila) industry, which has played an important role in technology transfer into and development of the regional economy. Cd. Juárez is home to the largest concentration of maquila employment and payroll in Mexico, and, as a result, the region has built itself into a major provider of manufacturing components that are distributed throughout North America. In 2007, Cd. Juárez maquilas employed about a quarter of a million workers, representing 20 percent of the total maquila jobs in Mexico. In addition, approximately 25 percent of Mexico's total production sharing output is manufactured in Cd. Juárez. As depicted in Figure 1, the industry follows U.S. industrial production cycles since demand is driven by U.S. consumption.

Figure 1. Cd. Juárez Maquiladora Employment and U.S. Manufacturing Industrial Production (seasonally adjusted)



Source: INEGI and AMAC for employment (seasonally adjusted by IPED) ; Federal Reserve Bank of Dallas for IP

Table 3. Fortune 500 Companies in Cd. Juárez

Chrysler	Flextronics	Lear	Siemens
Delphi	Ford	Lexmark	Sumitomo
Electrolux	Foxconn	North American Philips	Valeo
Emerson	Honeywell	R. Bosch	Wistron de Mexico
FCI	Johnson Controls	Scientific Atlanta	Yazaki

Source: AMAC

The manufacturing industry in Cd. Juárez is home to many Fortune 500 companies, such as those provided in Table 3, among others. They specialize in manufacturing industries related to motor vehicles, vehicle parts, industrial machinery, and computer, electronic and communications equipment.⁵ The top 10 employment industry groups are presented in Table 4. Table 5 shows a sample of their product line.

⁵ Olmedo, Carlos, McElroy, Mathew and Feser, Edward. "The Industry Clusters of Ciudad Juárez," Institute for Policy and Economic Development, IPED SR 2007-2.

Table 4. Top 10 Cd. Juárez Maquiladora Employment Industry Groups

Plants	NAICS	Description	Employment
67	3363	Motor Vehicle Parts Mfg.	82,422
41	3344	Semiconductor & Other Electronic Component Mfg.	30,564
24	3353	Electrical Equipment Mfg.	16,645
13	3391	Medical Equipment & Supplies Mfg.	12,384
5	3342	Communications Equipment Mfg.	7,969
3	32591	Printing Ink Mfg.	7,399
13	3345	Navigational, Measuring, Electromedical, & Control Instruments Mfg.	7,178
6	33431	Audio & Video Equipment Mfg.	6,847
26	3261	Plastics Product Mfg.	5,550
5	3352	Household Appliance Mfg.	4,705

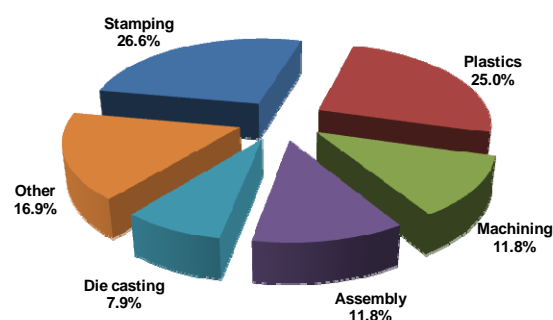
Source: AMAC; correspondence to NAICS performed by IPED.

Table 5. Sample of Product Line from Cd. Juárez Maquiladoras

Appliances	Coupon classification	Medical products	Seat covers
Apparel	Dashboards	Metal stamping	Speed control devices
Backplane (circuit boards) for telecommunications	Electric motors	Motor testing	Switchboards
Beeper & cellular connectors	Electronic connectors	PC boards	Switches
SMT	Engine testing	Photographic paper	Toys
Cast iron	Jalapeño peppers	Plastic injection molding	Trays
Coils	Lasertone cartridges	Repair of telephones	Valves
	Lighting devices	Leather seats	Wire harnesses

Source: AMAC

Survey-based estimates from AMAC show that Cd. Juárez maquilas consume \$8 billion worth of inputs, however, only two percent (\$160 million) are purchased from local suppliers. While a more exact value on inputs is difficult to quantify since it can only be obtained through analysis of thousands of *pedimentos* (documents used to clear shipments through Mexican Customs), the small percent captured by the local market reveals the opportunity for developing a greater regional supplier base. The estimated commodity use breakdown for Cd. Juárez maquila production is provided in Figure 2. As illustrated, the greatest opportunities for supplying parts and materials are in stamping, plastics and rubber, machining, assembly, and die casting. The market for some of these inputs can be narrowed to only a small number of firms.

Figure 2. Commodity Use Breakdown in Cd. Juárez Production

Source: AMAC

It is important to note that some steps have been undertaken in Cd. Juárez to develop relationships and procurement opportunities between suppliers and local maquilas. Promoting suppliers entails cost containment or cost reduction for maquilas (their very existence is based on cost containment), achieved through logistics and competitive advantages. Initiatives currently underway include:

- Supplier access to resources that enhance their business operations
- Training and presentation opportunities on joint ventures and strategic alliances
- Strategic sourcing and supplier diversity conferences
- Supplier diversity directory and best practices in supplier diversity (AMAC publication)
- Recognition to AMAC members and suppliers for significant achievements and excellence

New supplier initiative projects are listed in Table 6.

Table 6. Cd. Juárez New Suppliers Initiative Projects

Flextronics	Injection plastic molds; metal stamping; subassemblies	CDM Mfg. Design Center	Fixtures & spare parts
IMSSA I	Powder / E-coat	G&I Machining Works	Precision machine parts high volume
IMSSA II	High volume precision machine parts (shafts, gears)	Judson-Smith	Aluminum extrusion
Northwire	Cable manufacturer	PM Industries	Folding carton & packaging
Plastitec	Plastic injection molding	Delta Precision	PCB Manufacturer
CNC Technostamping	Metal stamping	Plásticos Diversificados	Plastic injection molding; shelter services & rework
Mfg solutions	Fasteners; precision machine parts high volume	Grupo Industrial	Aluminum & zinc injection die cast
Phillips Plastics Corp.	Plastic injection molding (automotive certified)	AMSC	Progressive metal stamping

Source: AMAC

El Paso Industrial Base

El Paso has evolved into a service-oriented economy over the past two decades,⁶ a period that witnessed a decline in the manufacturing base from 46,300 jobs at its peak in 1993 to 20,200 in 2007:Q3.⁷ Nonetheless, the area continues to specialize in various manufacturing subsectors (NAICS 3-digit, see Table 2), including those that are linked to the production sharing, economies of scale practiced between U.S./foreign multinationals and Cd. Juárez maquiladoras.⁸

Figure 3 below shows the employment, job growth, specialization, and wage levels for 19 of the 21 manufacturing subsectors in El Paso. Employment is depicted by “bubble” size, with the number of jobs

⁶ Cañas, Jesus, 2002. “A Decade of Change: El Paso’s Economic Transition of the 1990s,” El Paso Business Frontier, Federal Reserve Bank of Dallas, El Paso Branch, Issue 1.

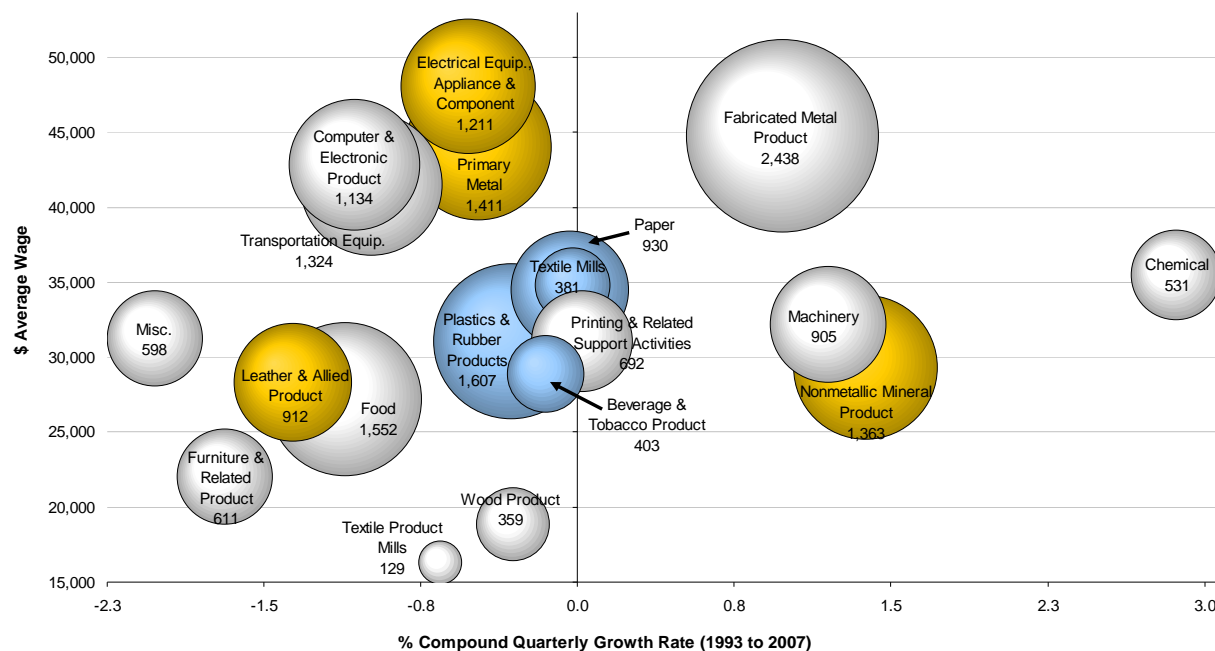
⁷ Quarterly Covered Employment and Wages (private sector data), Texas Workforce Commission.

⁸ Hanson, Gordon, 2001. “U.S. – Mexico Integration and Regional Economies: Evidence from Border-City Pairs,” *Journal of Urban Economics*, v50, 259-287.

below the respective titles. Compound quarterly growth rates (CQGR) measure job growth per quarter since 1993, the year that manufacturing peaked in El Paso. Specialization is measured through location quotients (LQs), a widely used tool in economic base theory. Basically, LQ values below 1 suggest that a region does not meet local demand for a certain good or service and must import the remaining demand. Levels above 1 suggest not only concentration but specialization that allows the region to export a portion of the industry's production after meeting local demand. LQs equal to or close to 1 suggest that local employment is exactly sufficient to meet local demand for a given good or service. The figure shows the following manufacturing trends:

- The largest employment subsectors are 1) Fabricated Metal Product, 2) Plastics & Rubber Product, and 3) Food, each employing over 1,500 persons;
- Six subsectors exhibit average wages above \$41,000, eight have wages between \$31,000 and \$36,000, four show wages between \$27,000 and \$30,000, and three show wages below \$23,000;
- The highest job growth rates occur in 1) Chemical, 2) Nonmetallic Mineral Product, and 3) Machinery, each growing above one percent per quarter since 1993; the greatest contraction, not surprisingly, occurs in Apparel, having lost over 20,000 jobs since 1993.

Figure 3. El Paso Manufacturing Subsectors (NAICS 3-digit), 2007



Source: IPED using private sector data from Quarterly Covered Employment and Wages, Texas Workforce Commission

Note: Two sub-sectors are not shown; 1) Apparel and 2) Petroleum & Coal Product. The CQGR for Apparel is -4.67 (since 1993), which falls far in the negative quadrant; Petroleum & Coal Product has a very high \$ average wage, which falls far above the observed vertical axis. By including them, the remaining industries become crowded and difficult to view, thus, they were omitted.

In addition:

- Six subsectors, in orange (two not shown, see note), had LQs of 1.5 or greater, meaning that while some of them may have contracted with regards to jobs, the area still specializes in them;
 - Leather & Allied Product (14.8)
 - Apparel (3.3)
 - Petroleum & Coal Product (2.1)
 - Primary Metal (1.7)
 - Electrical Equipment, Appliance and Component (1.6)
 - Nonmetallic Mineral Product (1.5)
- Four subsectors, in blue, had LQs between 1.1 and 1.2;
 - Textile Mills (1.2)
 - Plastics & Rubber Product (1.2)
 - Beverage & Tobacco Product (1.1)
 - Paper (1.1)
- Eleven manufacturing subsectors, in white, had LQs below 1.

Appendix A provides time series trends on employment and establishments for each of the 21 manufacturing subsectors in El Paso County. Changes in the employees to establishment ratio also provide insight into changes in productivity levels, with fewer employees per establishment potentially correlated to more technical or automated processes.

Findings

IPED examined detailed information on the inputs (commodity use) that typically go into the production processes similar to those found in Cd. Juárez. Identifying commodity use by Cd. Juárez manufacturing provides insight into El Paso supplier opportunities that can be developed as part of a growth strategy to restructure the region's declining manufacturing base and promote high paying service jobs.

The study started with 310 manufacturers in Cd Juárez, which were then truncated to *49 NAICS 4-digit industry groups* since multiple firms fall under the same industry group and use the same inputs in their production. Commodity use was ascertained and shares computed for 1) the manufacturing base in Cd Juárez as a whole and 2) the individual 49 industry groups. A share is interpreted as the percent of an input used out of the total cost of production, or, put another way, the number of cents of an input used out of every dollar spent. For example, a 3.5 percent share of commodity (x) for industry (y) means that 3.5 percent of the total cost of production by industry (y) is spent on commodity (x). Once commodity use shares were computed, the industries that make these commodities were examined, including whether or not they currently exist and specialize in El Paso along with their pay levels.

It should be noted that not all commodities that go into production processes as those in Cd Juárez were considered for analysis; only commodities made or sold by 1) manufacturing and 2) pre-selected information, professional and business support services were analyzed. The rationale for this is that the following sectors – agriculture, mining, utilities, construction, wholesale, retail, transportation, finance, real estate, education, health, entertainment, and accommodation, – are not the best candidates for allocating public resources to develop as suppliers to the maquiladora industry (e.g., education) or are already involved in the supply chain (e.g., transport). The commodities that were considered account for 80 percent of the total commodities used.

As discussed in the Cd. Juárez manufacturing section, AMAC estimates the most widely used inputs by maquiladoras are in stamping, plastics and rubber, machining, assembly, and die casting. With this in mind, a total of 18 industries (which may or may not exist in El Paso) estimated to be in greatest demand in Cd. Juárez are identified as “potential” industries and designated with a “p” in the below analysis. Table 7 lists these “potential” industries. The term “potential” is used because these industries are potential candidates for promotion (retention or growth strategy) or development (recruitment strategy) since demand, although broadly defined, has already been determined.

Table 7. Potential Industries w/ Commodities Estimated to be in High Demand in Cd. Juárez

IO Code	Description	IO Code	Description
325211	Plastics material & resin mfg.	32619A	Other plastics product mfg. (plastics plumbing fixtures & resilient floor covering)
325212	Synthetic rubber mfg.	326220	Rubber & plastics hoses & belting mfg.
326110	Plastics packaging materials & unlaminated film & sheet mfg.	326290	Other rubber product mfg. (for mechanical applications in vehicles & machinery)
326121	Unlaminated plastics profile shape mfg.	331520	Nonferrous metal foundries (for molds or dies to mfg. castings)
326122	Plastic pipe & pipe fitting mfg.	33211A	Misc. forging & stamping (iron, steel, nonferrous, & powder metallurgy parts)
326130	Laminated plastics plate, sheet (exc. packaging), & shape mfg.	332114	Custom roll forming
326140	Polystyrene foam product mfg.	33211B	Crown & closure mfg. & metal stamping
326150	Urethane & other foam product (exc. polystyrene) mfg.	332710	Machine shops
326160	Plastics bottle mfg.	332720	Turned product & screw, nut, & bolt mfg.

Source: IPED using AMAC demand estimates

Commodity Use by the Total Manufacturing Base in Cd. Juárez

For the initial analysis, the top 50 ranking commodities supplied across the 49 manufacturing industry groups in Cd. Juárez were selected. The industries that produce these commodities were then evaluated. Table 8 shows the results and is interpreted in the following manner: The columns under “SUPPLIER SECTORS” represent the top 50 industries that provide input to the total manufacturing base

in Cd. Juárez along with the respective commodity use share. The columns under “EL PASO” designate if the top 50 industries exist in El Paso via LQ and average wage values listed for the respective industry.⁹

The following is a summary of the commodity use by Cd. Juárez manufacturers depicted in Table 8:

- The top 50 industries account for 48 percent of the inputs that typically go into productions similar to the manufacturing activities in Cd. Juárez:
 - 13 of the top 14 industries currently operate in El Paso
 - 33 of the top 50 industries currently operate in El Paso
 - 12 industries specialize in El Paso with LQs greater than 1
 - 9 are “potential” industries estimated to be in high demand
 - 5 El Paso industries pay average wages above \$50,000
 - 13 El Paso industries pay average wages between \$35,000 and \$47,000
- 1st tier – 6 industries each have input shares of over 2 percent (rank 1 to 6):
 1. Iron & steel mills & ferroalloy mfg. (specializes w/ LQ 3.73, over 600 jobs, average wage \$35,000)
 2. Plastics material & resin mfg. (LQ 0.46, under 100 jobs, avg. wage \$34,000, potential industry)
 3. Motor vehicle parts mfg. (LQ 0.93, over 1,000 jobs, average wage \$40,000)
 4. Semiconductor & related device mfg. (LQ 1.14, over 400 jobs, average wage \$44,000)
 5. Paper mills (does not exist and unlikely to develop in El Paso)
 6. Printed circuit assembly mfg. (LQ 0.89, over 75 jobs, average wage \$68,000)
- 2nd tier – 8 industries each have input shares between 1 and 1.4 percent (rank 7 to 14):
 - 3 industries specialize in El Paso with LQs greater than 1:
 1. Other plastics product mfg. (e.g., plastics plumbing fixtures and resilient floor coverings, LQ 1.73, over 900 jobs, average wage \$34,000)
 2. Paperboard container mfg. (LQ 2.69, over 800 jobs, average wage \$34,000)
 3. Aluminum product mfg. (LQ 2.38, over 200 jobs, average wage \$40,000)
 - Includes 2 professional and 1 information service industries:
 1. Scientific R&D services (average wage \$57,000, over 300 jobs)
 2. Advertising & related services (average wage \$47,000, over 400 jobs)
 3. Software publishers (average wage \$74,000, over 50 jobs)
 - Includes 3 potential industries with inputs estimated to be in greatest demand in Cd. Juárez:
 1. Plastics packaging & unlaminated film & sheet mfg. (under 10 jobs, average wage \$18,000)
 2. Other plastics product mfg. (also listed above with LQ greater than 1)
 3. Machine shops (over 250 jobs, average wage \$24,000)

⁹ LQs were provided instead of detailed employment due to the nondisclosure agreement IPED has with TWC. IPED is prohibited from disseminating data that breaks the confidentiality of individual employers that file with TWC, such as disclosing exact employees and wages paid by a specific firm that can be used unfairly by competitors.

Table 8. Commodity Use by Total Manufacturing Activities in Cd. Juárez

Rank	EL PASO		SUPPLIER SECTORS			
	LQ	Avg. Wgs. (000s)	IO Code	Description	% Commodity Use	
p	1	3.73	35	331110	Iron & steel mills & ferroalloy mfg.	3.410
	2	0.46	34	325211	Plastics material & resin mfg.	3.076
	3	0.93	40	336300	Motor vehicle parts mfg.	2.741
	4	1.14	44	334413	Semiconductor & related device mfg.	2.499
	5	--	--	322120	Paper mills	2.331
	6	0.89	68	334418	Printed circuit assembly (electronic assembly) mfg.	2.092
p	7	0.01	18	326110	Plastics packaging materials & unlaminated film & sheet mfg	1.352
s	8	0.32	57	541700	Scientific research & development services	1.301
p	9	1.73	34	32619A	Other plastics product mfg.	1.286
	10	2.69	34	322210	Paperboard container mfg.	1.267
s	11	0.50	47	541800	Advertising & related services	1.183
p	12	0.66	24	332710	Machine shops	1.105
s	13	0.15	74	511200	Software publishers	1.076
	14	2.38	40	33131B	Aluminum product mfg. from purchased aluminum	1.076
	15	--	--	322130	Paperboard mills	0.984
	16	--	--	311930	Flavoring syrup & concentrate mfg.	0.956
p	17	--	--	332720	Turned product & screw, nut, & bolt mfg.	0.926
	18	0.03	38	334419	Other electronic component mfg.	0.924
	19	0.14	40	331510	Ferrous metal foundries	0.884
	20	--	--	325190	Other basic organic chemical mfg.	0.861
p	21	--	--	331520	Nonferrous metal foundries	0.822
	22	--	--	3259A0	All other chemical product & preparation mfg.	0.795
	23	--	--	334112	Computer storage device mfg.	0.746
	24	0.16	26	332800	Coating, engraving, heat treating & allied activities	0.734
	25	--	--	321100	Sawmills & wood preservation	0.689
	26	0.86	27	332310	Plate work & fabricated structural product mfg.	0.668
	27	--	--	325188	All other basic inorganic chemical mfg.	0.658
s	28	0.68	43	541100	Legal services	0.618
	29	1.40	25	332320	Ornamental & architectural metal products mfg.	0.612
	30	0.38	29	313310	Textile & fabric finishing mills	0.576
	31	2.49	71	331419	Primary smelting & refining of nonferrous metal (exc. copper i	0.574
s	32	0.63	46	541300	Architectural, engineering, & related services	0.571
	33	--	--	325220	Artificial & synthetic fibers & filaments mfg.	0.548
s	34	1.70	8	5419A0	All other miscellaneous professional, scientific, & technical s	0.539
	35	0.62	41	325510	Paint & coating mfg.	0.532
p	36	1.94	39	33211B	Crown & closure mfg. & metal stamping	0.521
p	37	--	--	326160	Plastics bottle mfg.	0.519
	38	--	--	33131A	Alumina refining & primary aluminum production	0.513
	39	0.01	20	334220	Broadcast & wireless communications equipment	0.503
	40	0.10	30	325610	Soap & cleaning compound mfg.	0.490
	41	--	--	335314	Relay & industrial control mfg.	0.483
s	42	0.34	25	541400	Specialized design services	0.480
s	43	0.77	37	541200	Accounting, tax preparation, bookkeeping, & payroll services	0.476
	44	0.12	8	334412	Bare printed circuit board mfg.	0.465
	45	--	--	332430	Metal can, box, & other metal container (light gauge) mfg.	0.453
p	46	--	--	325212	Synthetic rubber mfg.	0.448
	47	--	--	313210	Broadwoven fabric mills	0.419
s	48	5.17	25	561400	Business support services	0.410
	49	2.82	51	331420	Copper rolling, drawing, extruding & alloying	0.408
s	50	1.06	35	518200	Data processing, hosting, & related services	0.399
Total % commodity use by top 50						47.999

(p) denotes potential industries that make inputs estimated to be in greatest demand in Cd. Juárez ; (s) denotes service industries

Commodity Use by Cd. Juárez Manufacturing Industry Groups

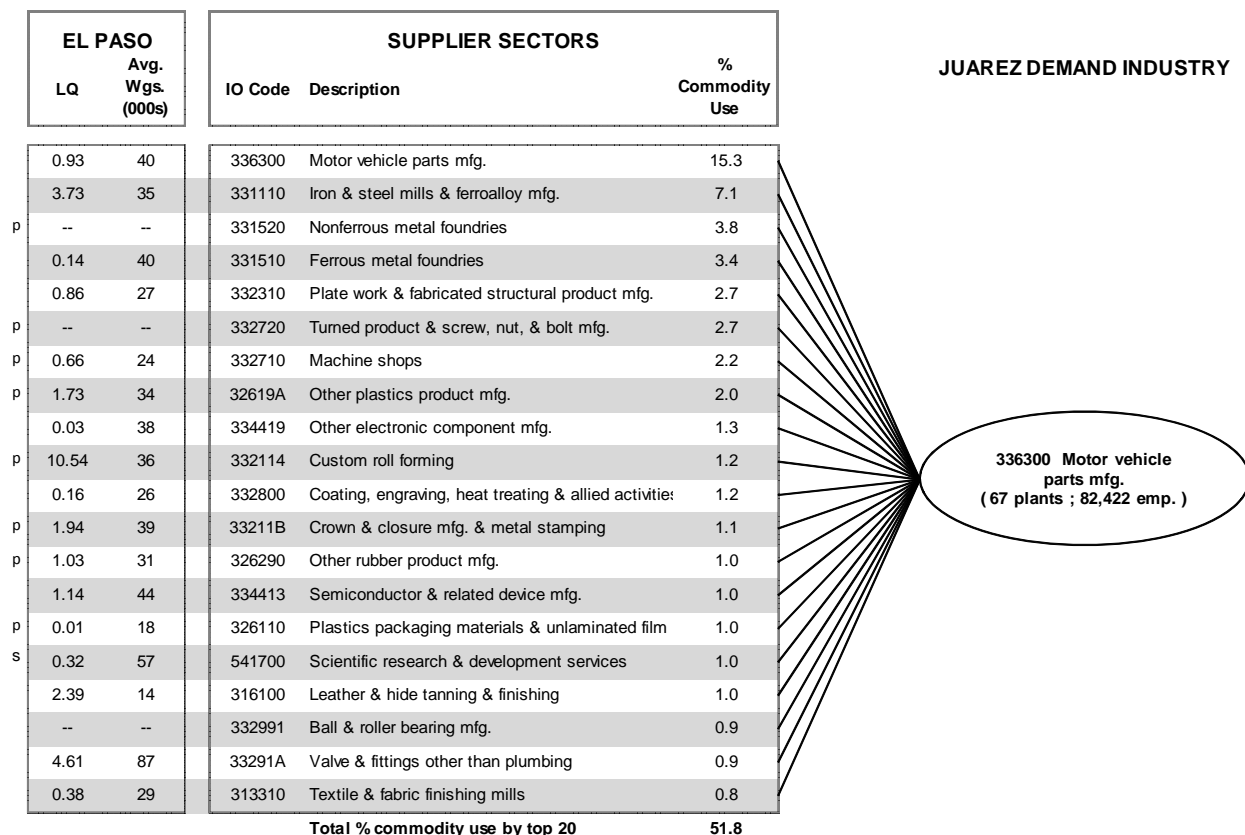
For the second analysis, the 10 largest employment industry groups in Cd. Juárez were selected (out of 49 total). For each of the 10 industry groups, the top 20 commodities used in their production processes and the industries that make these commodities were studied. In this case, employment is assumed to be positively correlated to the amount of inputs used in a production process. The rationale for this is that even when an industry is labor intensive (low capital-to-labor productivity), large employment operations are also likely to use a significant amount of inputs in their production, thereby creating sufficient demand for suppliers. It should be noted, however, that labor in Cd. Juárez maquilas is recognized as highly productive, meaning that industries with high employment can also be capital intensive. Thus, the positive association between employment and commodity use is strengthened.

Results are provided in Figure 4 through 13 and are interpreted as follows: The ovals under “JUAREZ DEMAND INDUSTRY” represent the top 10 employment industry groups in Cd. Juárez. Columns under “SUPPLIER SECTORS” represent the top 20 industries that provide the most input that each respective industry group in Cd. Juárez uses. Columns under “EL PASO” designate whether or not the respective industry exists in El Paso. Also, for Figure 4 through 13 below, “p” denotes potential industries that make inputs estimated to be in high demand in Cd. Juárez manufacturing, while “s” denotes a service industry.

1) Motor Vehicle Parts Manufacturing (82,422 jobs across 67 plants)

- 17 of the top 20 supplier industries operate in El Paso (EP)
- The top 3 commodities used account for 26.1 % of total inputs:
 - 1) Motor vehicle parts mfg. (15.3% share, over 1,000 jobs, average wage \$40,000)
 - 2) Iron & steel mills & ferroalloy mfg. (7.1% share, over 600 jobs, average wage \$35,000)
 - 3) Nonferrous metal foundries mfg. (3.8% share, does not exist in EP)
- 8 industries specialize in El Paso with LQs greater than 1
- 1 service industry
- 8 potential industries estimated to be in most demand (6 operate in EP)
- High paying and technology/technical industries to note:
 - 1) Valve & fittings except plumbing mfg. (EP specialization, over 800 jobs, average wage \$86,000)
 - 2) Scientific R&D services (EP import has growth potential, over 350 jobs, average wage \$57,000)
 - 3) Semiconductor & related device mfg. (EP specialization, over 400 jobs, average wage \$44,000)

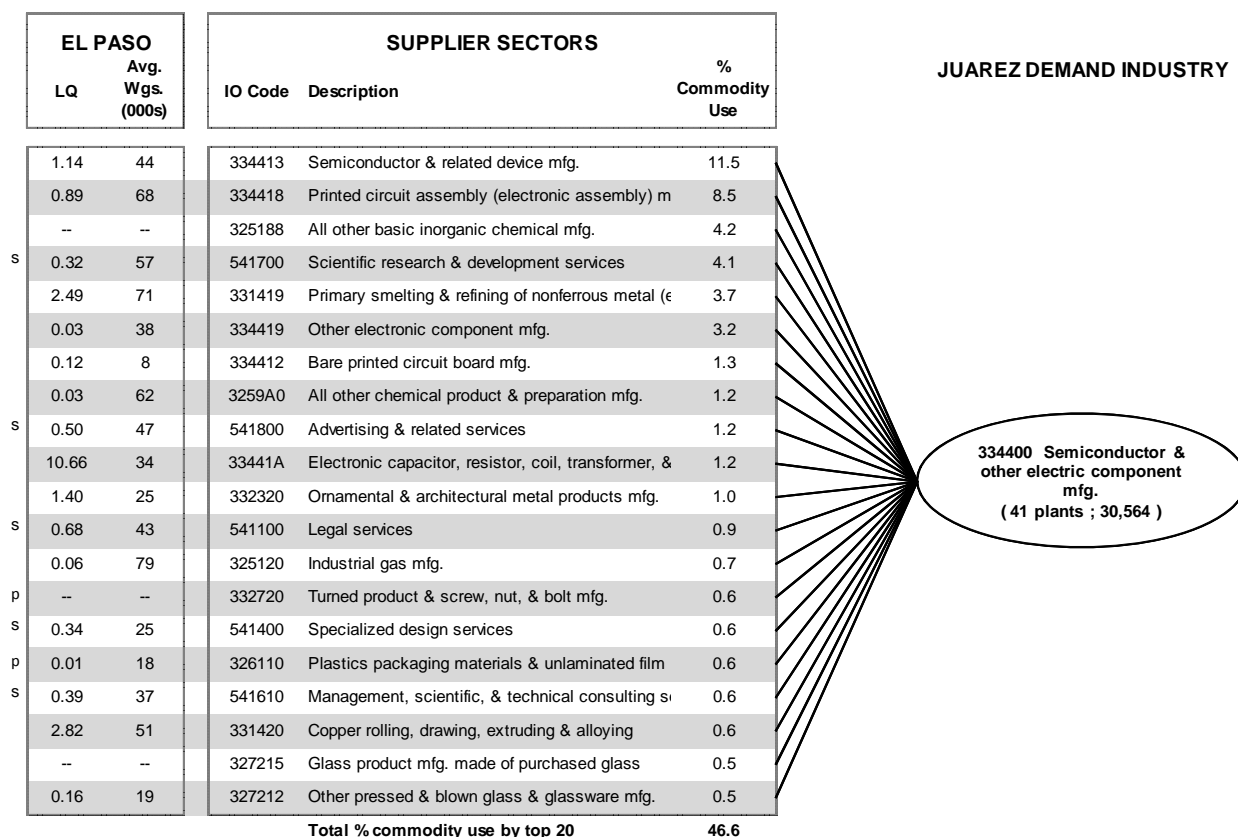
Figure 4. Commodity Use by Motor Vehicle Parts Manufacturing in Cd. Juárez



2) Semiconductor and Other Electric Parts Manufacturing (30,564 jobs across 41 plants)

- 17 of the top 20 supplier industries operate in El Paso
- The top 3 commodities used account for 24.2 % of total inputs:
 - 1) Semiconductor & related device mfg. (11.5% share, over 400 jobs, average wage \$44,000)
 - 2) Printed circuit (electronic) assembly mfg. (8.5% share, over 75 jobs, average wage \$68,000)
 - 3) All other basic inorganic chemical mfg. (4.2% share, does not exist in EP)
- 5 industries specialize in El Paso with LQs greater than 1
- 5 service industries
- 2 potential industries estimated to be in most demand (1 operates in EP)
- High paying and technology/technical industries to note:
 - 1) Printed circuit assembly mfg. (over 75 jobs, average wage \$68,000).
 - 2) Scientific R&D services (EP import has growth potential, over 350 jobs, average wage \$57,000)
 - 3) Copper rolling, drawing, extruding & alloy (EP specialization, over 150 jobs, avg. wage \$51,000)
 - 4) Semiconductor & related device mfg. (EP specialization, over 400 jobs, average wage \$44,000)

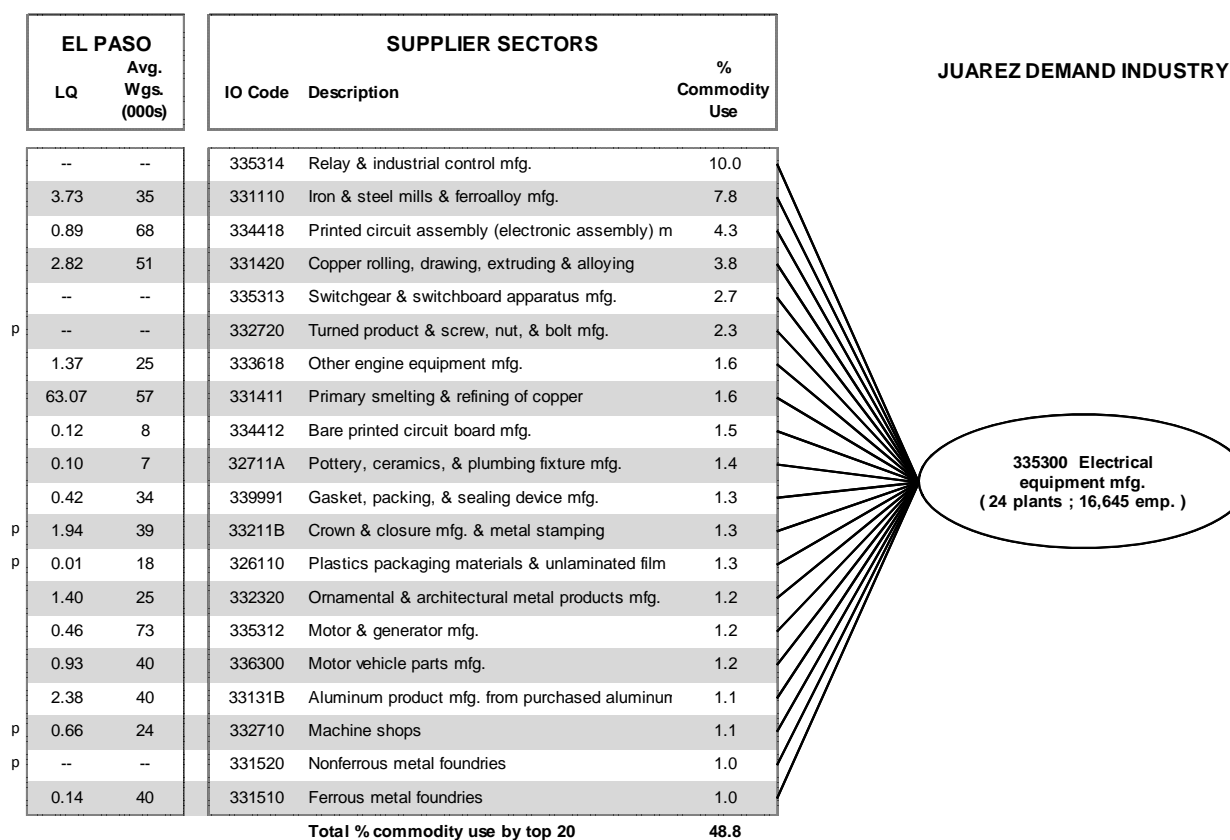
Figure 5. Commodity Use by Semiconductor & Other Electric Parts Manufacturing in Cd. Juárez



3) Electrical Equipment Manufacturing (16,645 jobs across 24 plants)

- 16 of the top 20 supplier industries operate in El Paso
- The top 3 commodities used account for 22.1 % of total inputs:
 - 1) Relay & industrial control mfg. (10.0% share, does not exist in EP)
 - 2) Iron & steel mills & ferroalloy mfg. (7.8% share, over 600 jobs, average wage \$35,000)
 - 3) Printed circuit (electronic) assembly mfg. (4.3% share, over 75 jobs, average wage \$68,000)
- 7 industries specialize in El Paso with LQs greater than 1
- 5 potential industries estimated to be in most demand (3 operate in EP)
- High paying and technology/technical industries to note:
 - 1) Motor & generator mfg. (over 40 jobs, average wage \$73,000)
 - 2) Printed circuit assembly mfg. (over 75 jobs, average wage \$68,000)
 - 3) Copper rolling, drawing, extruding & alloy (EP specialization, over 150 jobs, avg. wage \$51,000)

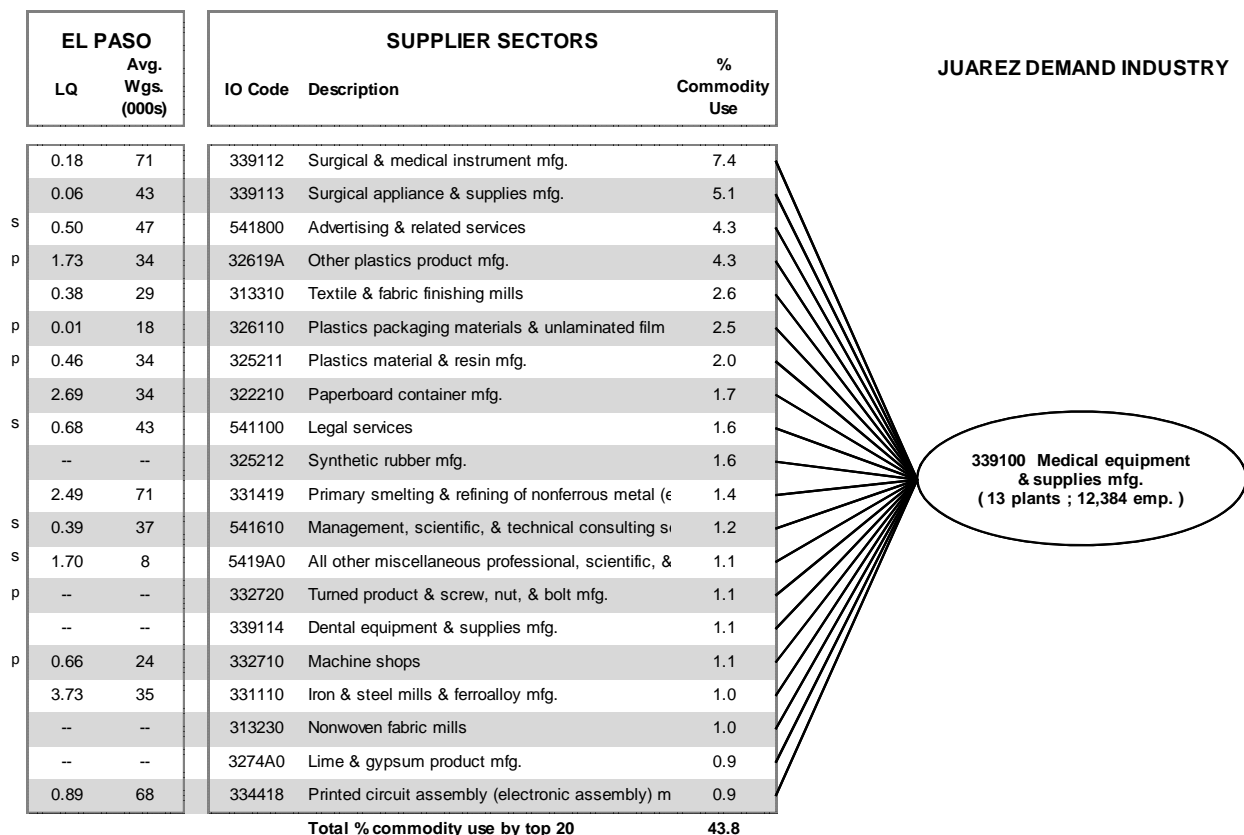
Figure 6. Commodity Use by Electrical Equipment Manufacturing in Cd. Juárez



4) Medical Equipment and Supplies Manufacturing (12,384 jobs across 13 plants)

- 15 of the top 20 supplier industries operate in El Paso
- The top 3 commodities used account for 16.8 % of total inputs:
 - 1) Surgical & medical instrument mfg. (7.4% share, over 25 jobs, average wage \$71,000)
 - 2) Surgical appliance & supplies mfg. (5.1% share, under 25 jobs, average wage \$43,000)
 - 3) Advertising & related services (4.3% share, over 400 jobs, average wage \$47,000)
- 5 industries specialize in El Paso with LQs greater than 1
- 4 service industries
- 5 potential industries estimated to be in most demand (4 operate in EP)
- High paying and technology/technical industries to note:
 - 1) Surgical & medical instrument mfg. (over 25 jobs, average wage \$71,000)
 - 2) Printed circuit assembly mfg. (over 75 jobs, average wage \$68,000)
 - 3) Surgical appliance & supplies mfg. (under 20 jobs, average wage \$43,000)

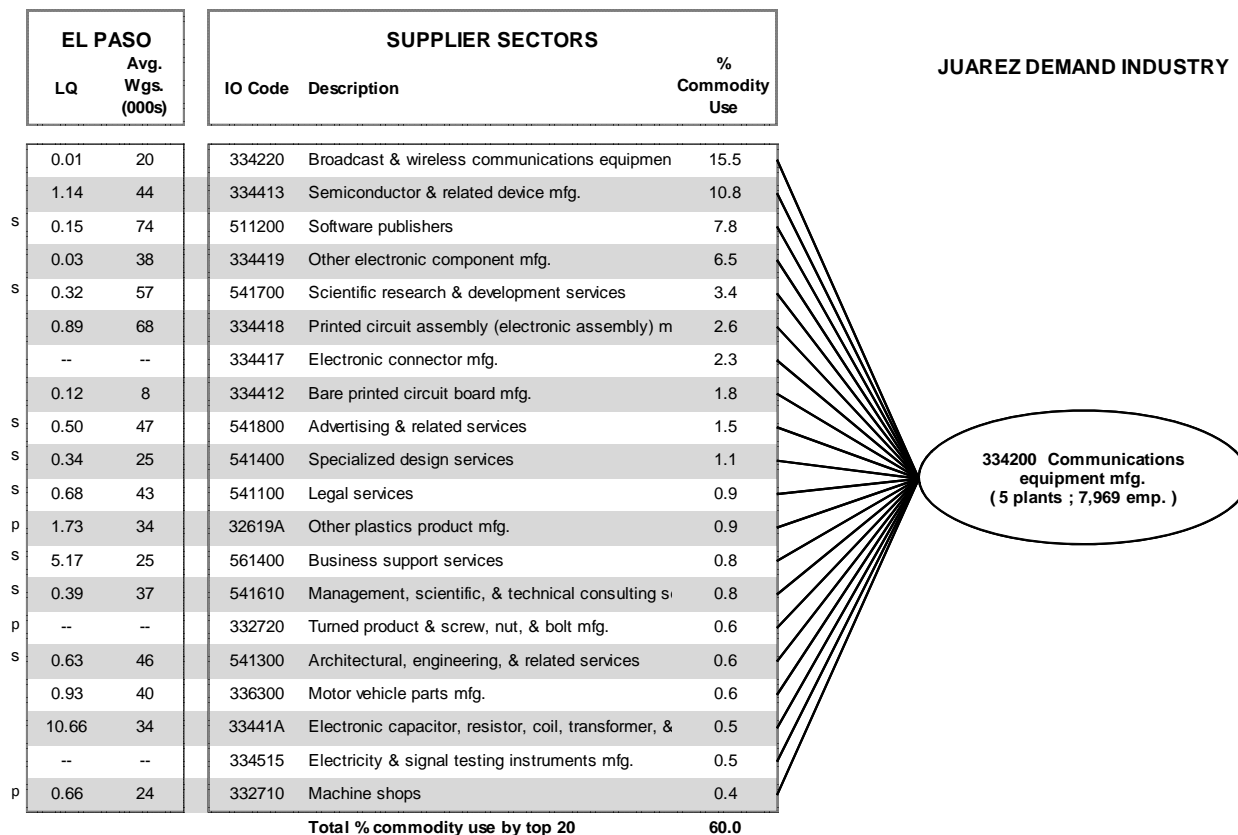
Figure 7. Commodity Use by Medical Equipment & Supplies Manufacturing in Cd. Juárez



5) Communications Equipment Manufacturing (7,969 jobs across 5 plants)

- 17 of the top 20 supplier industries operate in El Paso
- The top 3 commodities used account for 34.1 % of total inputs:
 - 1) Broadcast & wireless comm. equip. mfg. (15.5% share, under 10 jobs, average wage \$20,000)
 - 2) Semiconductor & related device mfg. (10.8% share, over 400 jobs, average wage \$44,000)
 - 3) Software publishers (7.8% share, over 50 jobs, average wage \$74,000)
- 4 industries specialize in El Paso with LQs greater than 1
- 8 service industries
- 3 potential industries estimated to be in most demand (2 operate in EP)
- High paying and technology/technical industries to note:
 - 1) Software publishers (EP import has growth potential, over 50 jobs, average wage \$74,000)
 - 2) Printed circuit assembly mfg. (over 75 jobs, average wage \$68,000).
 - 3) Scientific R&D services (EP import has growth potential, over 350 jobs, average wage \$57,000)
 - 4) Architectural, engineering & related services (EP import has growth potential, over 1,600 jobs, average wage \$46,000)
 - 5) Semiconductor & related device mfg. (EP specialization, over 400 jobs, average wage \$44,000)

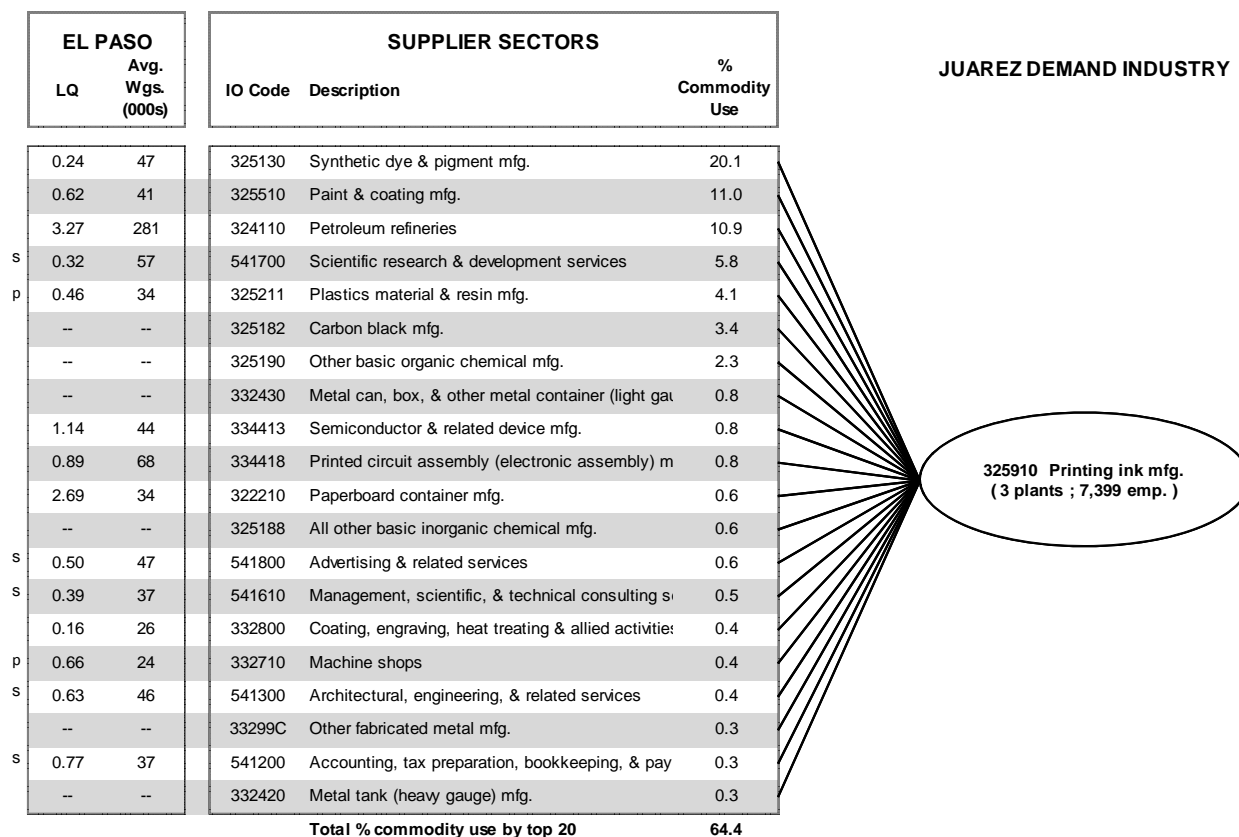
Figure 8. Commodity Use by Communications Equipment Manufacturing in Cd. Juárez



6) Printing Ink Manufacturing (7,399 jobs across 3 plants)

- 14 of the top 20 supplier industries operate in El Paso
- The top 3 commodities used account for 42 % of total inputs:
 - 1) Synthetic dye & pigment mfg. (20.1% share, under 10 jobs, average wage \$47,000)
 - 2) Paint & coating mfg. (11% share, over 25 jobs, average wage \$41,000)
 - 3) Petroleum refineries (10.9% share, over 400 jobs, average wage \$281,000)
- 3 industries specialize in El Paso with LQs greater than 1
- 5 service industries
- 2 potential industries estimated to be in most demand (both operate in EP)
- High paying and technology/technical industries to note:
 - 1) Printed circuit assembly mfg. (over 75 jobs, average wage \$68,000)
 - 2) Scientific R&D services (EP import has growth potential, over 350 jobs, average wage \$57,000)
 - 3) Synthetic dye & pigment mfg. (under 10 jobs, average wage \$47,000)
 - 4) Architectural, engineering & related services (over 1,600 jobs, average wage \$46,000)
 - 5) Semiconductor & related device mfg. (EP specialization, over 400 jobs, average wage \$44,000)

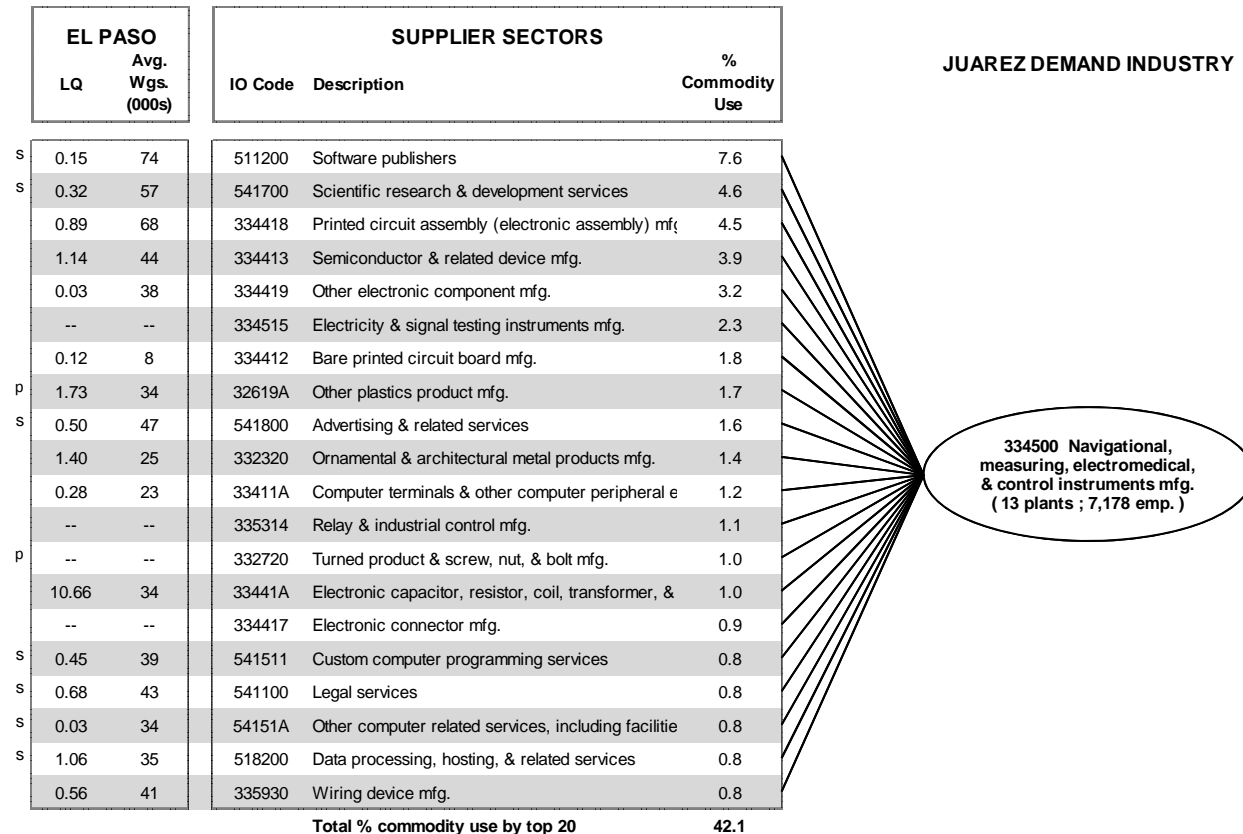
Figure 9. Commodity Use by Printing Ink Manufacturing in Cd. Juárez



7) Navigational, Measuring, Electromedical, & Control Instruments (7,178 jobs across 13 plants)

- 16 of the top 20 supplier industries operate in El Paso
- The top 3 commodities used account for 16.6 % of total inputs:
 - 1) Software publishers (7.6% share, over 50 jobs, average wage \$74,000)
 - 2) Scientific R&D services (4.6% share, over 350 jobs, average wage \$57,000)
 - 3) Printed circuit (electronic) assembly mfg. (4.5% share, over 75 jobs, average wage \$68,000)
- 5 industries specialize in El Paso with LQs greater than 1
- 7 service industries
- 2 potential industries estimated to be in most demand (1 operates in EP)
- High paying and technology/technical industries to note:
 - 1) Software publishers (EP import has growth potential, over 50 jobs, average wage \$74,000)
 - 2) Printed circuit assembly mfg. (over 75 jobs, average wage \$68,000)
 - 3) Scientific R&D services (EP import has growth potential, over 350 jobs, average wage \$57,000)
 - 4) Semiconductor & related device mfg. (EP specialization, over 400 jobs, average wage \$44,000)
 - 5) Wiring device mfg. (over 50 jobs, average wage \$41,000)

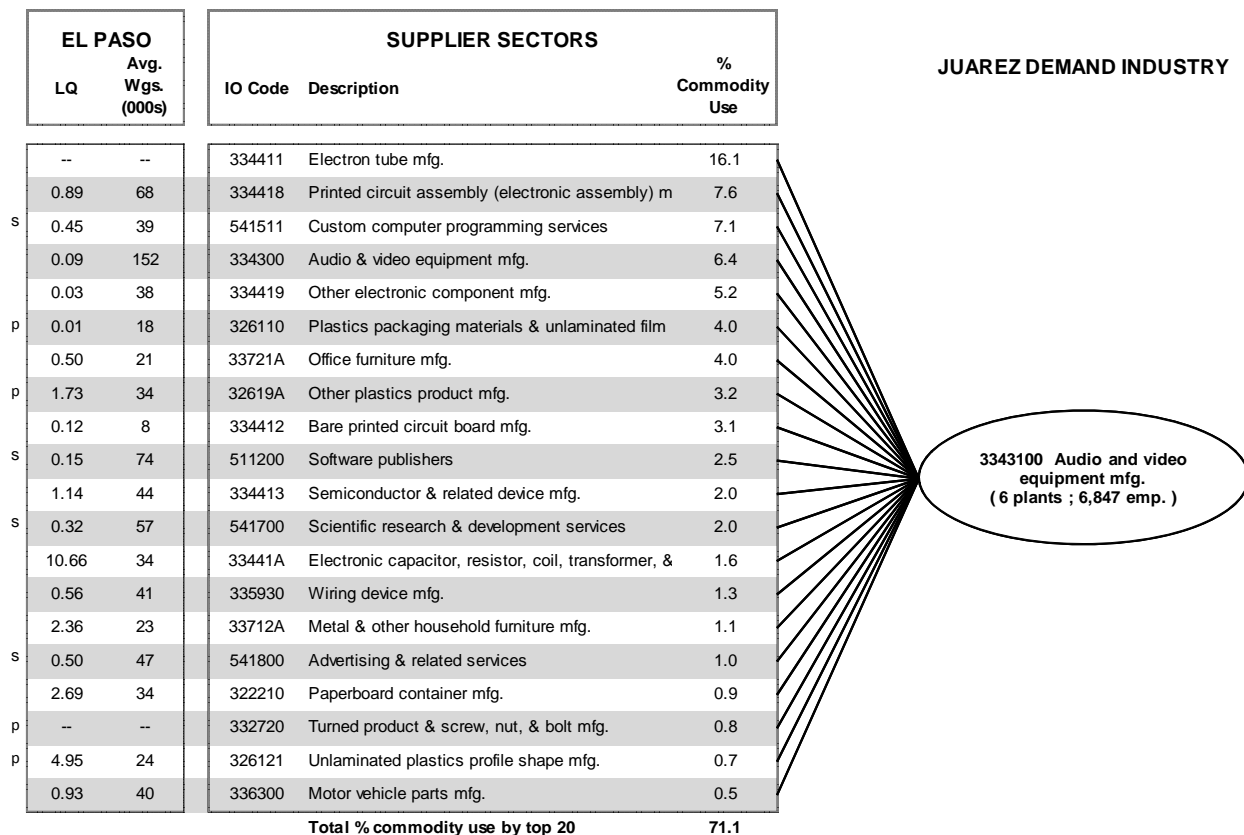
Figure 10. Commodity Use by Navigational, Measuring, Electromedical, & Control Instruments Manufacturing in Cd. Juárez



8) Audio & Video Equipment Manufacturing (6,847 jobs across 6 plants)

- 18 of the top 20 supplier industries operate in El Paso
- The top 3 commodities used account for 30.8 % of total inputs:
 - 1) Electron tube mfg. (16.1% share, does not exist in EP)
 - 2) Printed circuit (electronic) assembly mfg. (7.6% share, over 75 jobs, average wage \$68,000)
 - 3) Custom computer programming services (7.1% share, over 450 jobs, average wage \$39,000)
- 6 industries specialize in El Paso with LQs greater than 1
- 4 service industries
- 4 potential industries estimated to be in most demand (3 operate in EP)
- High paying and technology/technical industries to note:
 - 1) Audio & video equipment mfg. (under 10 jobs, average wage \$150,000)
 - 2) Software publishers (EP import has growth potential, over 50 jobs, average wage \$74,000)
 - 3) Printed circuit assembly mfg. (over 75 jobs, average wage \$68,000)
 - 4) Scientific R&D services (EP import has growth potential, over 350 jobs, average wage \$57,000)
 - 5) Semiconductor & related device mfg. (EP specialization, over 400 jobs, average wage \$44,000)
 - 6) Wiring device mfg. (over 50 jobs, average wage \$41,000)

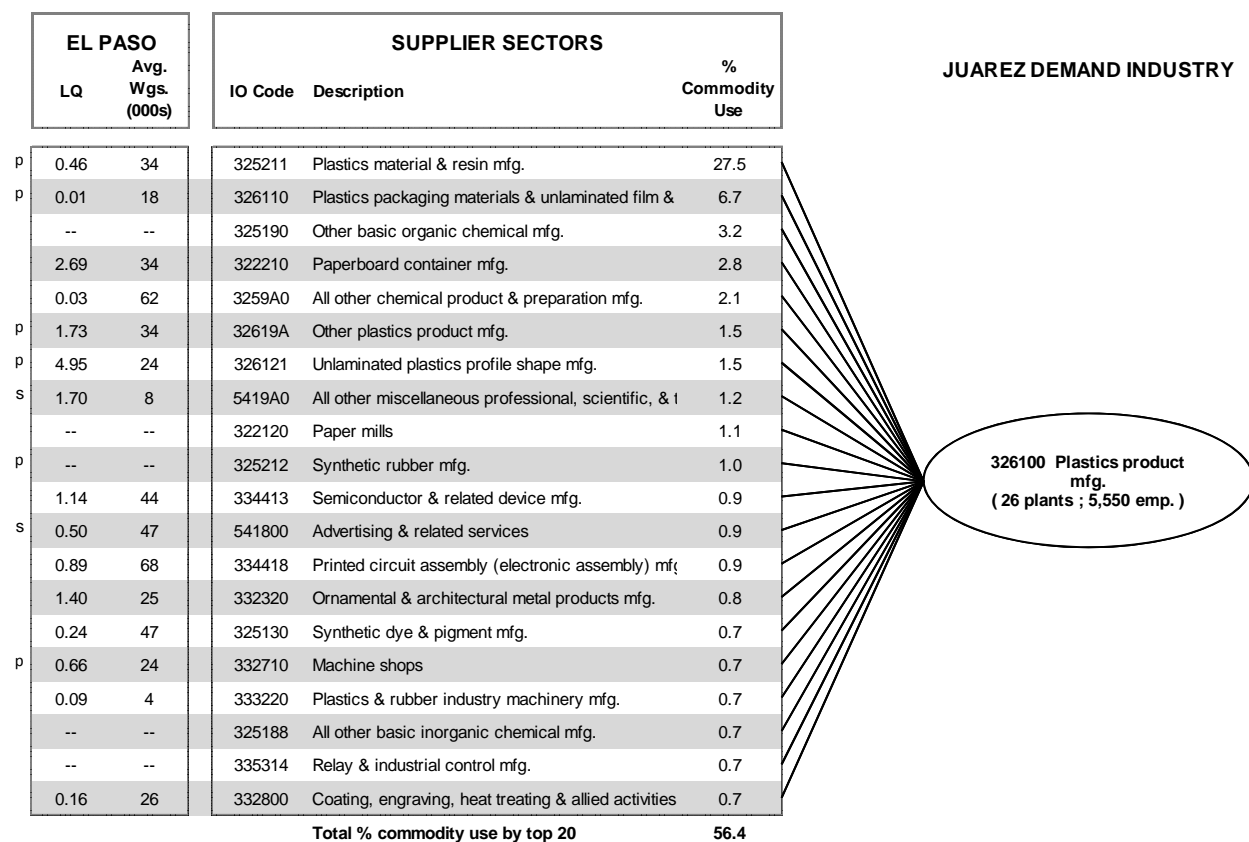
Figure 11. Commodity Use by Audio & Video Equipment Manufacturing in Cd. Juárez



9) Plastics Product Manufacturing (5,550 jobs across 26 plants)

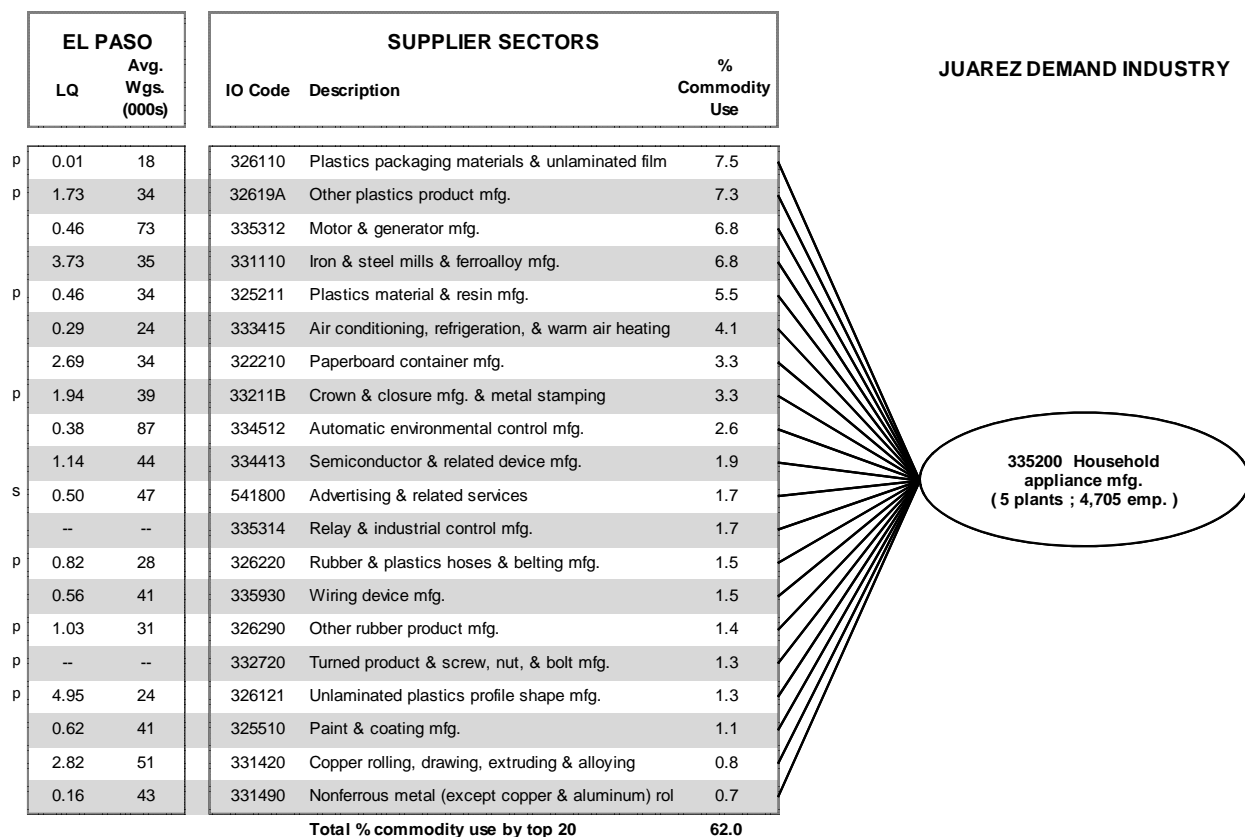
- 15 of the top 20 supplier industries operate in El Paso
- The top 3 commodities used account for 37.4 % of total inputs:
 - 1) Plastics material & resin mfg. (27.5% share, over 40 jobs, average wage \$34,000)
 - 2) Plastics packaging materials & unlaminated film & sheet mfg. (6.7% share, under 10 jobs, average wage \$18,000)
 - 3) Other basic organic chemical mfg. (3.2% share, does not exist in EP)
- 6 industries specialize in El Paso with LQs greater than 1
- 2 service industries
- 6 potential industries estimated to be in most demand (5 operate in EP)
- High paying and technology/technical industries to note:
 - 1) Printed circuit assembly mfg. (over 75 jobs, average wage \$68,000)
 - 2) Synthetic dye & pigment mfg. (under 10 jobs, average wage \$47,000)
 - 3) Semiconductor & related device mfg. (EP specialization, over 400 jobs, average wage \$44,000)

Figure 12. Commodity Use by Plastics Product Manufacturing in Cd. Juárez



10) Household Appliance Manufacturing (4,705 jobs across 5 plants)

- 18 of the top 20 supplier industries operate in El Paso
- The top 3 commodities used account for 21.6 % of total inputs:
 - 1) Plastics packaging materials & unlaminated film & sheet mfg. (7.5% share, under 10 jobs, average wage \$18,000)
 - 2) Other plastics product mfg. (7.3% share, over 900 jobs, average wage \$34,000)
 - 3) Motor generator mfg. (6.8% share, over 40 jobs, average wage \$73,000)
- 8 industries specialize in El Paso with LQs greater than 1
- 1 service industry
- 8 potential industries estimated to be in most demand (7 operate in EP)
- High paying and technology/technical industries to note:
 - 1) Automatic environmental control mfg. (under 25 jobs, average wage \$87,000)
 - 2) Motor & generator mfg. (over 40 jobs, average wage \$73,000)
 - 3) Semiconductor & related device mfg. (EP specialization, over 400 jobs, average wage \$44,000)
 - 4) Nonferrous metal rolling, drawing, extruding, & alloying (under 10 jobs, avg. wage \$43,000)
 - 5) Wiring device mfg. (over 50 jobs, average wage \$41,000)

Figure 13. Commodity Use by Household Appliance Manufacturing in Cd. Juárez

Summary of Commodity Use by Top Ten Manufacturing Industry Groups in Cd. Juárez

The commodities used by the top ten manufacturing industry groups in Cd. Juárez are summarized in Table 9. The Industries listed in the table were selected based on three criteria. First, industries were counted for the number of times they provided significant inputs across the 10 industry groups identified for Cd. Juárez. The “# of Industry Groups” category in Table 9 shows the number of groups that each industry serves. For example, the industry “Printed circuit assembly mfg.” supplies eight out of the 10 Cd. Juárez industry groups. Second, average wages were also analyzed and industries that meet an average wage threshold of \$34,000 were considered. The last criteria involved the omission of industries whose services are likely provided in-house or by the local market (e.g., legal and accounting), as well as some metal manufacturing that require high capital investment or those already specialized in the region.

Table 9. Number of Times Commodity Use is Found in the Top 10 Manufacturing Industry Groups in Cd. Juárez

EL PASO			SUPPLIER SECTORS		
LQ	Avg. Wgs. (000s)		IO Code	Description	# of Industry Groups
	0.89	68	334418	Printed circuit assembly (electronic assembly) mfg.	8
	1.14	44	334413	Semiconductor & related device mfg.	8
p	--	--	332720	Turned product & screw, nut, & bolt mfg.	8
p	0.01	18	326110	Plastics packaging materials & unlaminated film & sheet mfg.	7
s	0.32	57	541700	Scientific research & development services	6
p	0.66	24	332710	Machine shops	6
	2.69	34	322210	Paperboard container mfg.	5
	0.12	8	334412	Bare printed circuit board mfg.	5
	0.93	40	336300	Motor vehicle parts mfg.	4
s	0.39	37	541610	Management, scientific & technical consulting services	4
	10.66	34	33441A	Electronic capacitor, resistor, coil, transformer & inductor mfg.	4
p	0.46	34	325211	Plastics material & resin mfg.	4
	1.40	25	332320	Ornamental & architectural metal products mfg.	4
	--	--	335314	Relay & industrial control mfg.	4
s	0.15	74	511200	Software publishers	3
	2.82	51	331420	Copper rolling, drawing, extruding & alloying	3
	0.56	41	335930	Wiring device mfg.	3
p	1.94	39	33211B	Crown & closure mfg. & metal stamping	3
	0.16	26	332800	Coating, engraving, heat treating & allied activities	3
p	4.95	24	326121	Unlaminated plastics profile shape mfg.	3
	0.46	73	335312	Motor & generator mfg.	2
	0.24	47	325130	Synthetic dye & pigment mfg.	2
s	0.63	46	541300	Architectural, engineering, & related services	2
	0.62	41	325510	Paint & coating mfg.	2
s	0.45	39	541511	Custom computer programming services	2
	0.38	87	334512	Automatic environmental control mfg.	1
	4.61	87	33291A	Valve & fittings other than plumbing	1
	0.06	79	325120	Industrial gas mfg.	1
	0.06	43	339113	Surgical appliance & supplies mfg.	1
	0.18	71	339112	Surgical & medical instrument mfg.	1
p	10.54	36	332114	Custom roll forming	1
	1.06	35	518200	Data processing, hosting, & related services	1
	0.42	34	339991	Gasket, packing, & sealing device mfg.	1

(p) denotes potential industries that make inputs estimated to be in greatest demand in Cd. Juárez ; (s) denotes service industries

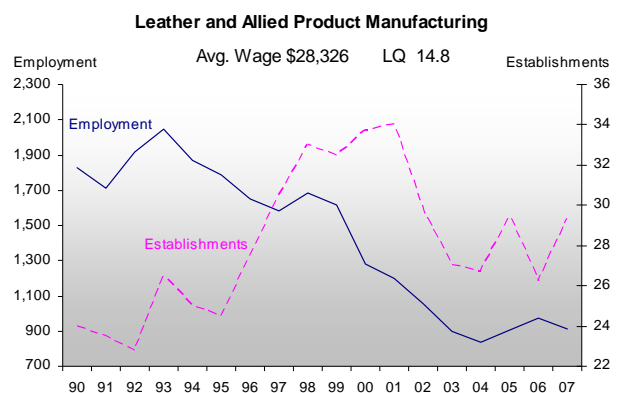
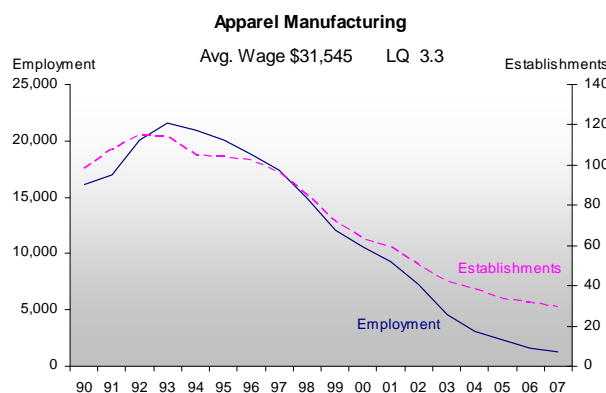
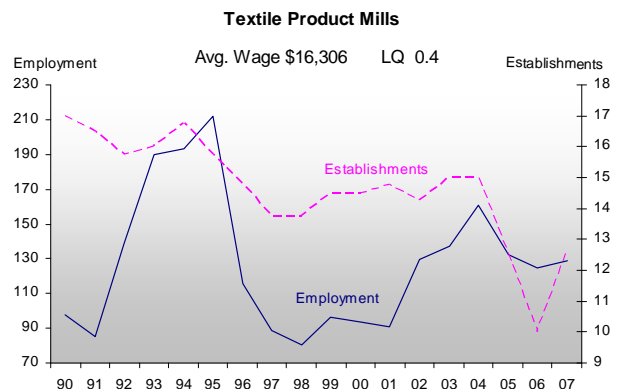
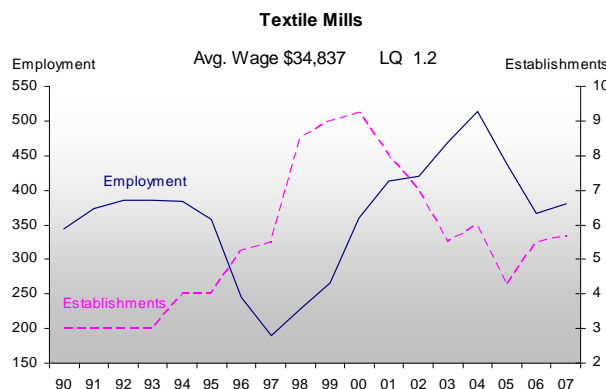
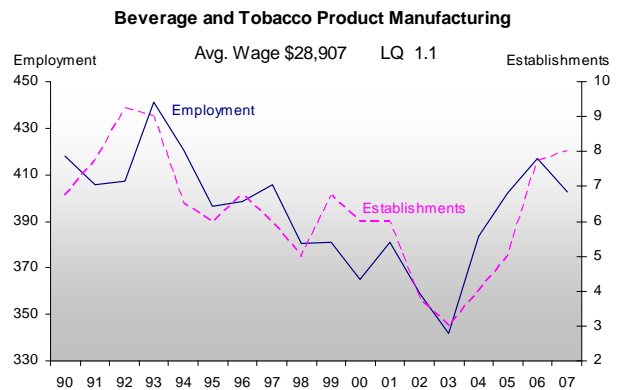
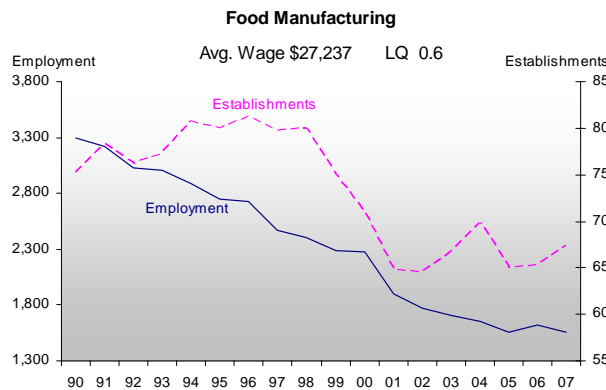
Conclusion and Next Steps

The conceptual I-O framework and methodology of this report offers a quantitative review of general commodities used by manufacturing activities in Cd. Juárez. Study findings serve to identify strategic and opportune linkages between manufacturing activities in Cd. Juárez and El Paso industries that can be promoted (retention and growth strategy) or developed (recruitment strategy). To obtain a more robust understanding of industry linkages, this initial research should be complemented with more refined “single” industry analysis and the results tied to “cluster” analysis, productivity measures and qualitative industry (survey-based) feedback. In addition, a recent collaboration may make it possible to obtain a NAICS-based, up-to-date list of manufacturers for Cd. Juárez. Future research should make an effort to incorporate these improved employment data sets. The following explains the potential steps to pursue:

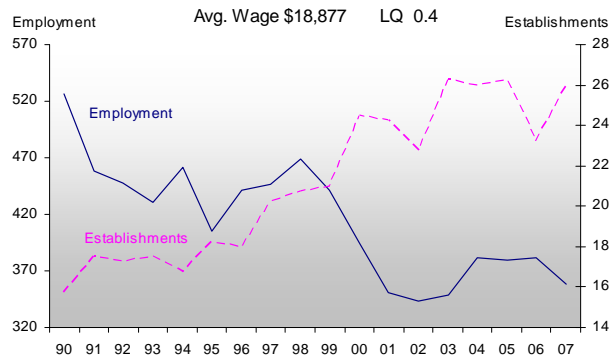
- Given the importance of developing growth strategies using the most reliable information, a similar study should be performed once improved NAICS-based data are available to re-calibrate results.
- Single industry (bottom-up) analysis should account for indirect links beyond the first tier links identified through commodities used by each industry. A technique that models how many rounds of multiplier spending it takes for a change in final demand in one sector to hit another sector may prove beneficial for further analysis. This measure would be an indicator of direct and indirect linkage and enhances the commodity needs of each industry beyond direct expenditures.
- Cluster (top-down) analysis studies a diverse set of industries that must have access to each other to ensure that they have access to supplies for production and customers for their products. Industries that are missing within a cluster are prime targets for development, especially for existing clusters that are primary drivers of the economy. Applying both a bottom-up and top-down approach provides a more reliable understanding of the impact of endorsing a set of specific industries by studying their commodity needs individually and as a member of a greater value chain.
- An additional step is to include a measure of productivity into the selection of manufacturing industry groups in Cd. Juárez. By taking into account the capital-intensity of certain productions, a better estimate of which industries demand greater amounts of inputs can be obtained.
- While this investigation tells us commodity use of manufacturing operations similar to those found in Cd. Juárez, it does not tell us which inputs are currently supplied locally and which inputs are able to be supplied from local vendors or service providers. Consequently, tying quantitative findings to qualitative survey-based information can assist in answering some of these questions, as well as in better understanding the opportunities and obstacles faced by existing and potential suppliers.

Appendix A

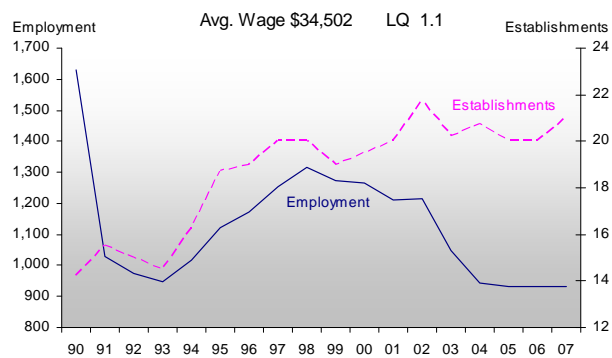
Employment and Establishment Trends for Manufacturing Subsectors in El Paso



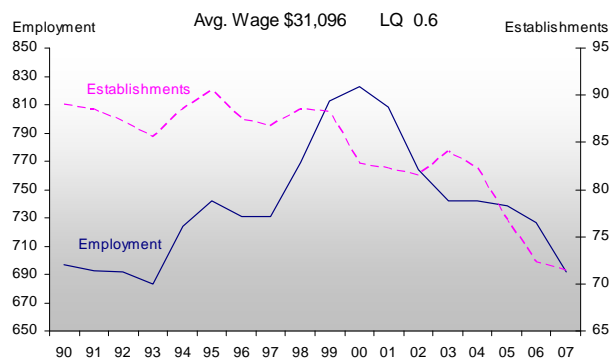
Wood Product Manufacturing



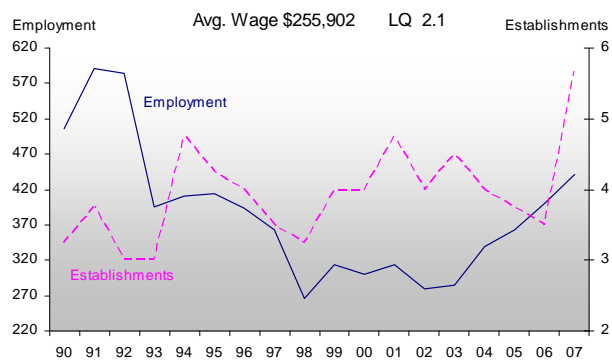
Paper Manufacturing



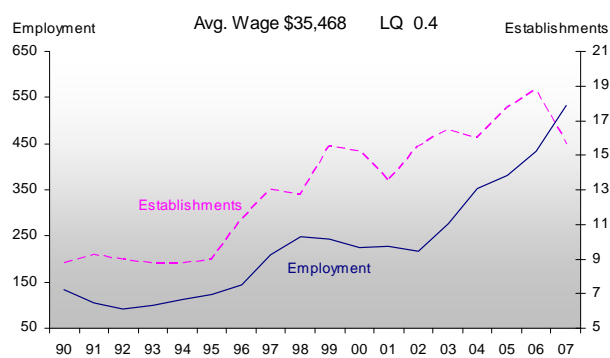
Printing and Related Support Activities



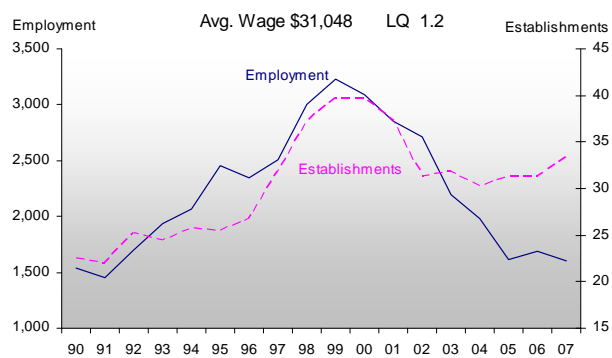
Petroleum and Coal Products Manufacturing



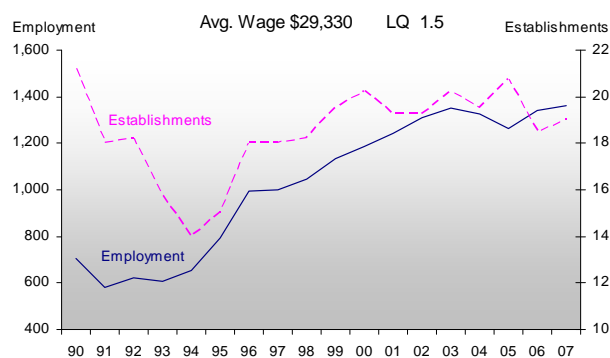
Chemical Manufacturing



Plastics and Rubber Products Manufacturing



Nonmetallic Mineral Product Manufacturing



Primary Metal Manufacturing

